WILDLIFE TOXICOLOGY FUND

REPORT 1988/1989

WILDLIFE TOXICOLOGY FUND

I. Background

The Wildlife Toxicology Fund (WTF) is a co-operative grant program initiated in 1985 by Environment Canada and World Wildlife Fund. The purpose of the program is "to provide high quality scientific information that can be directly applied to the protection of wildlife in Canada from irreversible harm caused by toxic chemicals in the environment." In addition, the WTF is intended "to enhance and develop private sector expertise, and to act as a stimulus for joint funding of research projects."

The first phase of the program ran from 1985 - 1988. Of the 53 projects funded during the first phase of the WTF, 32 final reports have now been received (Appendix A). Noranda Inc. provided the funds to cover the administrative costs of the program during the first three years.

The program was renewed in August, 1988 and will operate for an additional three years on the following basis. Environment Canada will provide $1 million over three years, provided WWF raises an additional $600,000 over three years for the program from other sources. World Wildlife Fund is administering the program by appointing jointly with Environment Canada a Research Advisory Board to receive and evaluate all proposals; by providing all application forms, brochures, announcements, etc; and by monitoring project progress and results in close co-operation with Environment Canada. Noranda Inc. continues to cover the administrative costs of the WTF, contributing $75,000 for the period (1988-1990).

To meet its objective of catalyzing funds from other sources, the WTF supports research proposals to a maximum of 50 percent of the cost of the project. Preference has been given for those proposals which foster practical, applied research of a high scientific quality and which provide information useful to Environment Canada.

The current funding guidelines for the WTF call for research proposals which will produce information useful to:

1. Assessment of substances on the Priority Substances List of the Canadian Environmental Protection Act and corresponding acts of participating provincial governments.

2. Pesticides, both chemical and microbial, on Environment Canada's priority list for review under the Pest Control Products Act or equivalent priorities identified by participating

provincial governments.

3. Topics of concern identified by the Canadian Wildlife Service, who participate in the inter-departmental program entitled Long Range Transport of Airborne Pollutants.

Further detail on the specific criteria within each of these categories is contained in Wildlife Toxicology Fund - Information for Applicants (Appendix B). These application guidelines, which are available in both English and French, have been distributed to all the universities across the country.

II. Projects Sponsored 1988 to Present

During the current phase of the Wildlife Toxicology Fund, 27 projects worth a total value of $2,833,977 have been funded. This represents a contribution of $1,032,817 from the Wildlife Toxicology Fund, which has been matched by outside sources in the amount of $1,801,160. A list of these projects is appended (Appendix C) and a brief description of each project is included (Appendix D). The projects cover a broad range of topics, ranging from the effects of acid rain on waterfowl, to the toxicity of dicofol on kestrels and the effects of toxic contaminants on the St. Lawrence Beluga Whale.

As of December, 1989, the WTF is currently supporting 27 projects at 18 institutions in seven provinces.

During the current phase of the program, a total of 27 project proposals have been refused.

III. Projects Sponsored During the First Phase of the Wildlife Toxicology Fund

As already noted, the WTF supported 53 projects during the first phase of the WTF (1985 - 1988). The WTF contributed a total of $2,307,446 which was matched by $3,626,094 in funding from outside sources. Many of these projects have now been completed and the results are being distributed broadly to scientists and decision-makers in government and industry.

In addition to World Wildlife Fund, the Canadian Wildlife Service, through Dr. David Peakall, keeps a set of these reports on file. These are available upon request.

The work has contributed greatly to an understanding of the effects of toxic chemicals on Canadian wildlife. For example:

* research on peregrine falcons in the Northwest Territories indicates that the birds have a significant amount of organic pesticide and PCB residues.

* acid deposition on a wetland ecosystem produces detrimental effects within the wetland and causes wetlands to release strong pulses of acids to downstream waters.

* PCP contamination poses a substantial threat to Gammarus tigrinus, an important food-chain link, by causing considerable respiratory stress.

* aerial spraying of malathion at sub-lethal concentrations is not likely to have long-term effects on juvenile walleye.

* Vitamin A levels in Great Lakes Herring Gulls are inversely related to the concentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin.

* high levels of toxic chemicals in the carcasses of St. Lawrence beluga whales correspond with a high incidence of various diseases, many of which are known to be induced by these compounds in experimental studies on other vertebrates.

* PAHs are strong candidates as chemical causes of liver tumours in fish under certain conditions, namely chronic, high level exposure in fish with inter-current diseases that mitigate natural resistance to low-level exposures.

A number of the projects are also contributing to the development of new techniques for assessing toxic chemicals. For example, researchers at Brock University have developed a novel instrument for gathering samples of effluent discharged to a waterbody during shock-loading events. They have also developed a reliable mutagenicity test for analyzing sediment chromotoxicity.

Follow-up on the final project reports will be a major activity for WWF staff during the coming year. The list of final reports is being distributed broadly to scientists and decision-makers in government and industry and the reports are forwarded to individuals as requested. WWF staff is in the process of reviewing all the reports and identifying specific opportunities for follow-up action.

A number of new funding partnerships have been established as a result of WTF funding. For example, researchers at the University of Saskatchewan were able to attract additional support from the Saskatchewan Government, the Saskatchewan Natural History Society and the Saskatchewan Wildlife Federation for a WTF project focusing on the effects of grasshopper insecticide on prairie wildlife. In Quebec, Dr. Pierre Beland's research on the effect of toxic chemicals on St. Lawrence marine mammals has attracted a broad base of additional funders, including: the Department of Fisheries and Oceans, Alcan Aluminum Ltd., the Quebec Government, the Quebec Wildlife Foundation, and Greenpeace.

IV. Future WTF Funding

At its Annual Meeting in Montreal on November 23, 1989, the Research Advisory Board concluded there is a need for more project proposals examining the effects of toxic chemicals on: ecosystems; terrestrial species; estuarine and marine environments; and Arctic ecosystems. More proposals dealing with the effects of pesticides and pulp mill effluent on wildlife will also be sought, as well as proposals dealing with comparative toxicology over a wide range of organisms. In addition, the Board decided to encourage proposals involving inter-university co-operation.

To accomplish this, WWF staff are developing an advertisement to be placed in a number of academic journals early in the new year. In addition, a mailing will be made to all Canadian universities with a copy of the revised WTF grant application.

V. New Donors

Since the beginning of the current phase of the WTF, World Wildlife Fund has actively sought new donors to the program. WWF has met and exceeded its commitment to raise $200,000 annually in each of the first two years of the renewed program.

Included among the new donors to the WTF are: Inco Ltd. ($150,000 over three years); Ontario Ministry of the Environment ($150,000 over three years); Quebec Ministry of the Environment ($50,000 over two years); Ontario Hydro ($8,000 over two years); Alcan Aluminum Ltd. ($49,000 over two years); Department of Fisheries and Oceans ($65,000 over two years); Northern Reflections ($21,079 for one year); and the Quebec Wildlife Foundation ($10,000 for one year).

WWF is very pleased to welcome these new donors to the Wildlife

Toxicology Fund. They have made it possible for WWF to honour its funding commitment to Environment Canada and have demonstrated the truly catalytic nature of the WTF program.

VI. Research Advisory Board

The Research Advisory Board of the Wildlife Toxicology Fund is comprised of a number of Canada's foremost experts in the field of wildlife toxicology. Dr. Donald A. Chant, Chairman of the Ontario Waste Management Corporation, serves as Chairman of the Research Advisory Board. The list of the Board members is attached (Appendix E).

The Research Advisory Board has met twice during the current phase of the Wildlife Toxicology Fund. A meeting was held in Toronto on October 20, 1988 and in Montreal on November 23, 1989.

VII. Administration of the Wildlife Toxicology Fund

According to the Memorandum of Understanding between WWF and Environment Canada, World Wildlife Fund is responsible for the administration of the Wildlife Toxicology Fund. Since the inception of the WTF in 1985, Noranda Inc. has contributed an annual grant to cover the administrative costs of the program. For 1988/1989, Noranda contributed $44,600 for this purpose. Monte Hummel, President of WWF Canada, and Pegi Dover, Vice-President Communications for WWF, serve as joint co-ordinators of the WTF. In addition, Margaret Chrumka, Projects Administrator for WWF, administers the activities of the Wildlife Toxicology Fund.

VIII. Public Awareness Activities

During the current phase of the WTF, WWF has continued to highlight the activities of the grant program in its Annual Report and in WWF's quarterly newsletter Working for Wildlife.

WWF participated fully in the media launch of the current phase of the Wildlife Toxicology Fund with the Hon. Tom McMillan in August, 1988 at the Centre for Inland Waters in Burlington, Ontario. Other media activities during the current phase of the WTF include a WTF press conference at the Beluga Whale symposium in Tadoussac, Quebec in September, 1989. The press conference was held to announce WTF's support for Dr. Pierre Beland's project on toxic contamination of St. Lawrence marine mammals, including beluga whales. The participation of Alcan Aluminum Ltd. and the

Department of Fisheries and Oceans in the funding of the project was also announced at that time.

In June, 1989, World Wildlife Fund and Environment Canada jointly hosted a Wildlife Toxicology Fund reception to mark Environment Week. The reception also provided an opportunity to welcome Inco Ltd. as a new donor to the Wildlife Toxicology Fund and to publicly announce the company's contribution. The reception was held at the Macdonald Block, at Queen's Park in Toronto, at the site of a sustainable development display sponsored by Noranda Inc. and Environment Canada.

The Hon. Lucien Bouchard, Federal Minister of the Environment, attended the reception. A majority of the new donors to the WTF were represented as well. A number of other individuals from the corporate and government sectors were also present.

In November, 1989, the WTF held a one-day seminar session at McGill's Macdonald College. Nine of the WTF's project co-ordinators provided presentations on their projects. In addition to the co-ordinators, members of the WTF's Research Advisory Board, as well as students and faculty of Macdonald College, attended the session. During the first phase of the WTF, similar sessions were held in Saskatoon and Ottawa and proved to be a valuable means of disseminating research information and for linking project co-ordinators with similar research interests.

A collection of these public awareness materials is appended (Appendix F).

IX. Summary

The Wildlife Toxicology Fund continues to act as a much needed source of funding for wildlife toxicology research. The paucity of other funding sources for this type of research is noted by those active in the area time and again.

In addition to funding work of a very high calibre, the Wildlife Toxicology Fund is providing important opportunities for graduate student training. For example, the first project funded by the WTF was undertaken by Dr. Frederick Leighton, of the University of Saskatchewan, and was entitled "Bioassays for the Toxicity of Petroleum Oil to Seabirds". As a direct result of WTF funding, the graduate student in the project has been fully trained as a toxicologist and pathologist and has accepted a position as a federal government research scientist focusing on the ecotoxicology of the St. Lawrence estuary.

World Wildlife Fund remains completely committed to meeting the goals of the grant program. It has succeeded in shouldering the additional fund-raising challenge presented by the current Memorandum of Understanding and has confidence that it will be able to meet these commitments over the long term. WWF is also devoting increasing staff resources to the administration of the WTF to ensure a strong element of project follow-up.

WWF looks forward to continuing and strengthening the working partnership that has been established with Environment Canada and Noranda. It also looks forward to continuing its work with the more recent supporters of the WTF.

Appendix A

WWF World Wildlife Fund
Fonds Mondial pour la Nature

Canada

60 St. Clair Avenue E., Suite 201
Toronto, Ontario M4T 1N5
Telephone: (416) 923-8173
Facsimile: (416) 923-6177

November, 1989

NOTICE

A list of reports available from the Wildlife Toxicology Fund follows. To obtain a copy of one or more of the reports, please contact Pegi Dover at World Wildlife Fund, Suite 201, 60 St. Clair Avenue East, Toronto, M4T 1N5 or telephone her at 416-923-8173.

• Winner of the Canadian Environmental Achievement Award - 1989 •

This paper is made from recycled material, including post-consumer waste.

Final Reports For Wildlife Toxicology Fund Projects

(Please indicate the reports you would like to receive and return to Pegi Dover, WWF, Suite 201, 60 St. Clair Ave. East, Toronto, M4T 1N5.)

1. "Burdens of Ionic Alkylleads in Pigeons and Eels from Metropolitan Montreal and Environs", Dr. W.D. Marshall, Macdonald College, McGill University.

2. "Behavioural and Reproductive Correlates of Reduced Levels of Cholinesterase Activity in Zebra Finches Following Acute Exposure to Fenitrothion", Dr. Peter Boag, Queen's University.

3. "The Effects of Aluminum on Amphibians", Dr. Gordon McDonald and Dr. Joseph Freda, McMaster University.

4. "Effects of Hexazinone on Small Mammal Populations", Mr. David Penner, McCourt Management Ltd.

5. "Bioassays for the Toxicity of Petroleum Oils to Birds", Dr. Ted Leighton, WCVM, University of Saskatchewan.

6. "Lipids and Hydrocarbons in Corophium volutator (Pallas) from Minas Basin, Nova Scotia", Dr. Robert Ackman, Dept. of Oceanography, Dalhousie University.

7. "The Pharmacological and Ecological Effects of Malathion Treatments on Juvenile Walleye", Dr. F.J. Ward, University of Manitoba.

8. "Levels of Toxic Chemicals in Selected Birds in Manitoba", Dr. Merlin Shoesmith, University of Manitoba.

9. "Experimental Acidification of a Freshwater Wetland", Dr. Suzanne Bayley, University of Manitoba.

10. "The Development of Retinoid Monitoring for Dioxins and Related Compounds", Dr. Thomas Moon and Dr. Philip Spear, University of Ottawa.

11. "A Toxicological Assessment of Peregrine Falcon Breeding in the Keewatin District of the Northwest Territories", Mr. Gordon Court, University of Alberta

24. "The Significance of Neoplasia in Wild Fish Populations", Dr. Tony Hayes, University of Guelph.

25. "Development of Models to Describe the Dynamics of Toxic Organic Chemicals in the Environment and Wildlife of the Great Lakes Basin", Dr. Don Mackay, University of Toronto.

26. "Winter Feeding Ecology of Gulls near Presqu'ile Provincial Park, Ontario", Dr. Erica Nol, Trent University.

Reports Received as of November 15th, 1989

27. "Effects of Soil Acidification and Local Smelter Emmissions on the Cadmium content of Soils, Forage and Fecal Pellets in Deer Yards of the Sudbury-Manitoulin Area", Dr. Glenn Parker, Laurentian University.

28. "Biological Significance of Trace Metals in Sediments", Dr. A. Tessier, INRS-Eau, University of Quebec.

29. "Effects of Silvicultural Herbicide Use on the Breeding Birds of Regenerating Forest Clearcuts in Nova Scotia", Dr. Bill Freedman, Dalhousie University.

30. "Exposure Indicators for Metals Discharged by a Smelter", Dr. J. Klaverkamp, U. of Manitoba.

31. "Toxins in Rocky Mountain Forage Legumes --- A Preliminary Assessment", Dr. M.A.M. Bell, University of Victoria.

32. "Behaviour and Reproduction Correlates of Reduced Levels of Cholinesterase Activity in Zebra Finches Following Acute Exposures to Fenitrothion", Dr. Peter Boag, Queen's University.

Reports Received as of April 12th, 1989

12. "The Investigation dynamics of Organic Contaminant Uptake by Natural Sesnon", Dr. R.H. Peters, McGill U.

13. "The Impacts of Sugar Maple Decline on Insectivorous Birds", Dr. Yves Mauffette, U. of Quebec at Montreal.

14. "Metal Accumulation by Larval Chironomids", Dr. Pamela Stokes, University of Toronto.

15. "Effects of Lake Acidification and Cadmium on Avian Species", Dr. J. Barlow, U. of Toronto.

16. "The Effect of PCP on Gammarus tigrinus", Dr. F. Baerlocher, Mount Alison University.

17. "Environmental Toxicology of the Welland River Wetland Area", Dr. Mike Dickman, Brock University.

Reports Received as of June 7th, 1989

18. Post Chernobyl 134 Cs and 137 Cs levels at Some Localities in Northern Canada. (Article in Journal of the Arctic Institute of North America. Final Report still to come.)

19. "Metal Sequestration in Marine Bivalaves of the NE Pacific", Dr. R. Reid, University of Victoria.

20. "Mercury Pathways --- the role of benthic Invertebrates", Dr. P. Stokes, University of Toronto.

Reports Received as of July 28th, 1989

21. "The Impact of Strychnine on Burrowing Owls", Dr. Paul James, Museum of Natural History.

22. "Effects of Hexazinone on Small Mammal Populations", Mr. David Penner, Penner and Associates ltd.

23. "Study of the Effects of Toxic Metal Pollutants on a Cellular System Pertinent to Aquatic Wildlife", Dr. Francine Denizeau, University of Quebec at Montreal.

WILDLIFE TOXICOLOGY FUND

Environment Canada | Environnement Canada

WWF WORLD WILDLIFE FUND CANADA
FONDS MONDIAL POUR LA NATURE CANADA

Grant Application

Please consult the current Wildlife Toxicology Fund (WTF) brochure before completing this form.

Principal Applicant's Name and Address	Sponsoring Canadian Institution

Date of Application

Applicant's Telephone No.

Co-applicants, if any

☐ New application with original proposal attached ☐ Renewal with progress report attached

Short Title of Project

Synopsis of Project

Financial Summary (Fiscal Year: April 1 - March 31)

Starting Date of Project	Fiscal Period	Total Project Budget	Amount Requested from WTF	Note
Current Year	19____ - 19____	$	$	The present salary guidelines used by the Natural Sciences and Engineering Research Council of Canada (NSERC) must be followed. Please attach a separate detailed budget as required for the current and subsequent year's request.
Subsequent Years	19____ - 19____	$	$	
	19____ - 19____	$	$	
TOTALS		$	$	

Matching Funding (50% or more of total project budget)

Have you already obtained matching funding for this project?

☐ Yes ☐ No If yes, please itemize sources and amounts below. If no, indicate sources which are being or will be approached.

SOURCE	AMOUNT
	$
	$
	$

Signatures (Please type and sign)

I hereby agree to all the conditions, including those regarding eligibility, reporting and financial accounting, as outlined in the current Wildlife Toxicology Fund brochure.

Principal Applicant Name (typed)	Position	Signature
Chair or Head of Dept.		
Other Authorizing Signature (e.g., Research Officer or Senior Management of the sponsoring agency)		

All applications and inquiries should be directed to:

EXECUTIVE CO-ORDINATOR
Wildlife Toxicology Fund
c/o World Wildlife Fund Canada
60 St. Clair Avenue East, Suite 201
Toronto, Ontario M4T 1N5

Telephone: (416) 923-8173

FONDS POUR LA TOXICOLOGIE FAUNIQUE

Environnement Canada Environment Canada

WWF WORLD WILDLIFE FUND CANADA
FONDS MONDIAL POUR LA NATURE CANADA

Demande de subvention

Avant de remplir le présent formulaire, veuillez lire attentivement notre brochure portant sur le Fonds pour la toxicologie faunique.

Nom et adresse du principal demandeur	Commanditaire (Institution canadienne parrainant le projet)

Demande en date du

N° de téléphone du demandeur

Co-demandeurs, si c'est le cas

☐ Nouvelle demande, accompagnée de la proposition d'origine ☐ Renouvellement, accompagné d'un rapport d'étape

Titre abrégé du projet

Objectifs recherchés par le projet (en résumé)

Exercice budgétaire (résumé) Année fiscale: 1er avril au 31 mars

Projet commençant le	Période fiscale	Estimation du budget total	Somme demandée au F.T.F.
Année en cours	19____-19____	$	$
Années suivantes	19____-19____	$	$
	19____-19____	$	$
TOTAUX		$	$

Note

On doit respecter les échelles de salaire du Conseil des sciences naturelles et de la recherche en ingénierie du Canada.

Prière de joindre aux demandes de cette année ou des années suivantes un estimé budgétaire détaillé.

Fonds de contrepartie (représentant 50% ou plus du budget total du projet)

Avez-vous déjà obtenu des fonds de contrepartie pour la réalisation de ce projet?

☐ Oui ☐ Non Si oui, veuillez énumérer ci-dessous leur origine et leur montant.

ORIGINE	MONTANT
	$
	$
	$

Signatures (Veuillez imprimer votre nom et y apposer votre signature)

J'accepte de respecter toutes les conditions inhérentes au fonds, y compris les exigences portant sur l'admissibilité, les rapports et le procédés comptables, telles que définies dans la brochure sur le Fonds pour la toxicologie faunique.

Principal demandeur	Nom (dactylographié)	Poste	Signature

Doyen ou directeur de la faculté

Autres signatures autorisées, telles que l'agent de recherche ou la direction de l'organisme commanditaire

Toute demande de subvention ou de renseignements doit être adressée à:

COORDONNATEUR EXÉCUTIF
Fonds pour la toxicologie faunique
a/s Fonds mondial pour la Nature Canada
60 est, avenue St. Clair, Bureau 201
Toronto, Ontario M4T 1N5

Téléphone: (416) 923-8173

December 1, 1989

WILDLIFE TOXICOLOGY FUND

WILDLIFE TOXICOLOGY FUND: GRANT COMMITMENTS 1988/1991

	88/89	89/90	90/91
1. Dr. S. Perry/ U. of Ottawa/ The Metabolic Consequences of Environmental Acidification	$38,000	$35,200	
2. Dr. David Bird/ McGill U./ The Effects of Dicofol on Kestrels	$18,424		
3. Dr. H. Harvey/ U. of Toronto/ Transfer of Metals from the Aquatic Environment to Wildlife	$6,000		
4. Dr. Philip Spear/ U. of Mont at Quebec Vitamin A --- Related Mechanisms of Dioxin Toxicity	$19,995	$31,450	$30,200
5. Dr. Peter Boag/ Queen's U./ Sub-Lethal Effects of Organophosphate Insecticides on Learning and Memory in Birds	$22,840		

6. Dr. J. Barlow/ U. of T./ The Effect of Lake Acidification and Cadmium on Avian Species	$12,464	$11,959	
7. Dr. T. Hutchinson/ U. of T./ Effect of Acidic Fogs on Trees	$20,000	$20,000	
8. Dr. Mike Dickman/ Brock U./ Bioindicators of Sediment Bound Toxins	$8,000		
9. Dr. P. Weatherhead/ Carleton U./ Effects of Acidic Precipitation on Waterfowl	$13,500	$3,000	$11,500
10. Dr. Erica Dunn/ Long Point Bird Observatory/ Influence of Lake Acidification on Loons	$21,875	$22,181	$23,290
11. Dr. Bill Freedman/ Dalhousie U./ Effects of Acidic Precipitation on Waterfowl	$22,400	$21,975	
12. Mr. David Penner/ Penner & Associates Ltd.,/ Effects of Hexazinone Herbicide on Small Mammals		$30,838	
13. Dr. Suzanne Bayley/ U. of Manitoba/ Experimental Acidification of a Wetland Ecosystem		$35,000	$35,000

14. Dr. J.F. Bendell/ University of Toronto/ Impact of Bt on Chicks of Spruce Grouse, non-target insects and Small Birds and Mammals		$14,450	
15. Dr. Keith Solomon/ U. of Guelph/ Effects of Carbofuran on Mallard Ducklings		$5,500	
16. Dr. B. Webster/ U. of Manitoba/ Effects of Environmental Exposure to Carbofuran		$49,000	$12,000
17. Dr. P. Beland/ St. Law. National Instit. Effects of Toxic Chemicals on St. Lawrence Marine Mammals	$25,000	$25,000	$25,000
18. Dr. K. Cheng/ UBC/ Dioxins and Great Blue Herons		$16,300	
19. Dr. F. Schwab/ Acadia U./ Effects of Lead on Waterfowl		$33,600	
20. Dr. F. Ward/ U. of Man./ Effects of Toxaphene on Lake Trout		$20,000	$20,000
21. Dr. M. Berrill/ Trent U./ Effects of Pyrethroid on Amphibians		$20,000	$20,000

22. Dr. L. Hare/ U. of Quebec/ Toxicity of Trace Metals to Benthic Invertebrates		$20,000	$20,000
23. Dr. P. Campbell/ U. of Quebec/ Biochemical Indicators of Enviro. Stress/		$15,000	$30,000
24. Dr. R. Reid/ U. of Victoria/ Effects of Pulp Mill Effluent on Bottom Fish		$20,000	$20,000
25. Dr. Brian McMahon/ U. of Calgary/ Acid Stress and Freshwater Clams		$15,703	$20,023
26. Dr. Jacob Kalff/ McGill U./ Mercury in Freshwater Fish		$19,450	$11,800
27. Dr. John Steeves/ U.B.C./ Effects of Dioxin on Avian Nervous System		$21,750	$18,150
TOTALS	$228,498	$507,356	$296,963

GRAND TOTAL = $1,032,817

Appendix D

DESCRIPTION OF WTF PROJECTS FUNDED AUGUST, 1988 - DECEMBER, 1989

1. "Metabolic Consequences of Environmental Acidification"

Co-ordinator:

Dr. Steve F. Perry
Dept. of Biology
University of Ottawa

Description:

Dr. Perry is exploring whether the stressful nature of external acidification on fish induces metabolic re-partitioning such that internal energy resources are re-directed toward maintenance at the expense of growth and reproduction. His research utilizes two important fish species known to inhabit acidified waters, brook trout and lake trout.

The study is intended to: 1) establish the mechanisms that cause reduced growth in chronically acid-exposed fish presented with abundant food; and 2) provide fisheries managers with sensitive biochemical indicators to assess the impact of sub-lethal acidification on natural fish populations. In a broader sense, it is expected that the research will provide wildlife managers with an understanding of the decline of piscivorous waterfowl communities (e.g. loons, ospreys, herons, eagles and kingfishers) inhabiting moderately acidified wetland ecosystems in which fish are still abundant.

Funding:

The WTF approved a grant of $73,200 for this project.

Matching Funds:

The Ontario Ministry of Natural Resources and the Natural Sciences and Engineering Research Council provided the matching funds for the project.

2. "Effects of Dicofol on Kestrels"

Co-ordinator:

Dr. David M. Bird
Macdonald College Raptor Research Centre
McGill University

Description:

Dr. Bird, in cooperation with Dr. Michael Fry and co-workers at the University of California at Davis, are investigating the eggshell-thinning effects of the pesticide dicofol and its potential for causing second generation abnormalities in the American Kestrel.

This study includes monitoring of reproductive functions in both first and second generation Kestrels by measuring fertility, eggshell thickness and morphology of the reproductive systems of both generations. Dicofol causes thinning in the eggshells of Ring Doves and this study is important to determine whether sensitive species such as falcons are proportionally at risk from dicofol as they are from DDE.

It is considered that this information will be valuable in the planned examiniation of the registration of dicofol by Environment Canada.

Funding:

The WTF approved a grant of $60,906 for this project.

Matching Funds:

The Natural Sciences and Engineering Research Council and the University of California have provided matching funds for the project.

3. "Transfer of Metals from the Aquatic Environment to Wildlife"

Co-ordinator:

Dr. Harold H. Harvey
Dept. of Zoology
University of Toronto

Description:

The project is seeking to develop a better understanding of the factors that influence the availability of metals in lake sediments, benthos, and fishes to fur-bearing mammals. To date, the researchers have determined the concentration of 14 elements in chironomid larvae, emergent winged adults, two species of crayfish, a benthic feeding fish and fur-bearing mammals from four to five study lakes. As the physio-chemical conditions of the five study lakes are different, they have been able to assess the role of pH and sediment redox conditions on influencing metal availability to biota.

Because of the different physio-chemical conditions of the study lakes, two major geochemical controls can be identified: 1) reducing environments where metal availability is controlled by sulphide formation; and 2) oxidising environments where availability is controlled by absorption onto oxide surfaces. The researchers hope to confirm the presence of these two geochemical controls through the sequential extraction of the sediments of the five study lakes. The predominant ligands that the trace metals are associated with will be related to the known metal concentration in benthic insect larvae, emergent adults, crayfish, fish and mammals.

Funding:

The WTF approved a grant of $6,000 for the current phase of the project. Earlier support in the amount of $62,451 had been awarded by the WTF.

Matching Funds:

The Ontario Ministry of Natural Resources provided the matching funds for the project.

4. "Vitamin A-Related Mechanisms of Dioxin Toxicity"

Co-ordinator:

Dr. Philip Spear
Dept. of Biology
University of Quebec

Description:

The polyhalogenated dibenzo-p-dioxins, dibenzofurans, certain biphenyls, and other similarly-acting contaminants are typically found as complex mixtures in the environment. The exact composition of these mixtures varies both geographically and temporally, besides being difficult and costly to measure. Dr. Spear's research has shown that these compounds elicit an array of effects upon the dynamics and metabolism of retinoids (vitamin A). Some of the changes in retinoid concentrations can be useful in sensitive, bio-effects monitoring for the "dioxin-like" contaminants. Having developed ways to monitor for the dioxin-like compounds, the next step is to understand how the effects are produced and the implications of such effects.

The work is exploring mechanisms responsible for the low vitamin A stores in adult birds and altered forms of vitamin A (retinoids) in the eggs of birds inhabiting the more highly contaminated areas of the Great Lakes. Controlled experiments with the Ring dove and Japanese quail conducted in conjunction with the environmental studies will confirm the actions of the dioxin-like compounds. Knowledge of the related mechanisms will facilitate the establishment of cause-effect relationships, allow predictions of effects arising from other contaminants having similar biochemical mechanisms, and help to identify possible interactions with disease including immunosuppression, and more severe effects such as embryo mortality and teratogenesis.

Funding:

The WTF approved a grant of $81,645 for this project.

Matching Funds:

The Natural Sciences and Engineering Research Council, Hoffman-Laroche Co. and Health and Welfare Canada provided matching funds for the project.

5. "Sub-Lethal Effects of Organophosphate Insecticides on Learning and Memory in Birds"

Co-ordinator:

Dr. Peter Boag
Dept. of Biology
Queen's University

Description:

Most of the chemical insecticides currently in use in Canadian agriculture and forestry are anti-cholinestrase agents. There is growing evidence that exposure of wildlife species to these agents is extensive and that, in some situations, mortality of exposed individuals is widespread. A key question in assessing the full impact of anti-cholinesterase insecticides on wildlife populations is whether sub-lethal exposure can affect the long term health, survival and reproductive potential of exposed individuals. Because sub-lethally dosed individuals eventually recover from gross symptoms of intoxication, and because others appear to still be functional despite drastically reduced cholinesterase levels, it has been argued that much of the sub-lethal exposure to anti-cholinesterase agents is without serious consequence to the exposed individuals.

The aim of the proposed research is to test this assumption and to investigate some of the possible consequences of sub-lethal exposure to these agents.

The test system used was the food-caching behaviour of Blackcapped Chickadees under captive conditions. Results to date indicate that memory retrieval in our test system may not be affected by realistic exposures to our model insecticide, fenitrothion. Further work is proposed to look at memory formation and/or consolidation as potential targets of anti-cholinesterase agents.

Funding:

The WTF approved a grant of $22,840 for this project.

Matching Funds:

Environment Canada, Health and Welfare Canada and Queen's University provided matching funds for the project.

6. "Effect of Lake Acidification and Cadmium on Avian Species"

Co-ordinator:

Dr. Jon C. Barlow
Department of Zoology
University of Toronto

Description:

Many studies have shown acid precipitation to be detrimental to ecosystem stability and cadmium to be toxic to certain organisms. However, little is known about the effects of acid rain and Cd on wild bird populations. The reproductive success of birds may be affected by acid rain as a consequence of either disrupted resource transfer (food quantity), or "toxicity" resulting from increased and/or insufficient levels of various trace elements (food quality). In addition, because Cd (at concentrations below present Canadian standards) may accumulate in the tissues of aquatic organisms which form the diet of certain birds species, it may also be transferred to, and accumulate to toxic levels in the birds themselves.

The Experimental Lakes Area in northwestern Ontario, a field station specializing in whole-lake manipulation experiments, was chosen to examine the extent of these responses and behaviour of selected bird species. In addition, trace element accumulation in the tissues of these birds in the vicinity of lakes which are either receiving Cd additions, or which have been experimentally acidified will be assessed.

Funding:

The WTF approved a grant of $24,423 for this project.

Matching Funds:

The Natural Sciences and Engineering Research Council provided the matching funds for the project.

7. "Effect of Acidic Fogs on Trees"

Co-ordinator:

Dr. Tom Hutchinson
Institute of Environmental Studies
University of Toronto

Description:

Fog in mountainous regions and even at low altitudes has been found to be more acidic and with a greater concentration of ions than acid rain. It wets all leaf surfaces and is in contact with vegetation for long periods of time. As a result, acid fog presents a potentially serious stress to plants.

Dr. Hutchinson and his research team are trying to determine the effect of acid fogs on the foliage of key tree species, exhibiting dieback and decline in part of their range. Specifically, Dr. Hutchinson will: 1) determine whether leaves of trees neutralise acidic fogs and to what extent; 2) measure how much leaf surface deposits in situ contribute to the neutralization or acidification process; 3) determine whether acidic fog causes damage to leaf surfaces, particularly to the stomata; and 4) determine whether leaves collected in the field are deficient in key nutrients or have abnormal levels of heavy metals.

Funding:

The WTF approved a grant of $40,000 for this project.

Matching Funds:

The Natural Sciences and Engineering Research Council and the Canadian Forestry Service provided the matching funds for the project.

8. "Bioindicators of Sediment Bound Toxins"

Co-ordinator:

Dr. Mike Dickman
Dept. of Biological Sciences
Brock University

Description:

This project is exploring the use of chironomid labial plate deformities as indicators of the presence of mutagenic materials in river sediments.

Recently, the Ontario Ministry of Environment removed sediments contaminated with coal tars from the mouth of the Welland River. Through the research, Dr. Dickman hopes to determine whether the frequency of chiromonid labial plate deformities downstream of this site will decrease following this cleanup. This information will prove valuable to future cleanup operations. In addition, it may also help to establish a time scale for the recovery rate of benthic invertebrate populations following contaminated sediment removal.

Funding:

The WTF approved a grant of $8,000 for this project.

Matching Funds:

The Laidlaw Foundation provided the matching funds for the project.

9. "Effects of Acidic Precipitation on Waterfowl"

Co-ordinator:

Dr. Patrick Weatherhead
Dept. of Biology
Carleton University

Description:

The project is examining the effects of acid precipitation on waterfowl in northern Ontario. Specifically, Dr. Weatherhead hopes to identify whether waterfowl, particularly common Goldeneyes, experience differential breeding success on acid and non-acid wetlands. The project is considering specific ecological and behavioural mechanisms responsible for the observed breeding success, and how these mechanisms are affected by acid precipitation.

To date, the research has revealed that Goldeneyes consistently preferred to nest on fishless lakes over lakes with fish, but showed no preference for lakes of high or low pH. Goldeneyes did not initiate nests later or have significantly smaller clutches on pH wetlands, but late-nesting birds did have significantly greater variation in the size of eggs within their clutch than birds nesting on higher pH lakes. However hatching success was similar.

Using these results, the research team expects to find that female Goldeneyes assess acid and fishless wetlands as being of higher quality, due to higher invertebrate populations. They predict, however, that overall waterfowl productivity from acid wetlands may actually decline due to acid-related toxic effects. The research team hopes to identify particular wetland types at the greatest risk and those best suited for waterfowl production, providing valuable information for the creation of management steps for waterfowl protection and conservation.

Funding:

The WTF approved a grant of $28,000 for this project.

Matching Funds:

The Natural Sciences and Engineering Research Council, the Canadian Wildlife Service and Carleton University provided the matching funds for the project.

10. "Influence of Lake Acidification on Loons"

Co-ordinator:

Dr. Erica Dunn
Long Point Bird Observatory

Description:

Common Loons nesting on very acidified lakes in Ontario have reduced reproductive success. The Long Point Bird Observatory has undertaken studies with three objectives: 1) to determine whether the negative relationship between lake acidity and reduced breeding success on loons holds over a wider geographic area; 2) to learn the mechanisms by which acidity affects success; and 3) to assess the use of volunteer observers in a long-term monitoring program, using the Common Loon as an indicator of water quality in Ontario.

In general, this study is examining the effect of a pollutant on wildlife species, and evaluating the use of that species as an indicator of lake quality on a broad scale. It is also viewed as valuable in determining whether monitoring of loons can track the effectiveness of governmental guidelines on allowable emissions of sulphates.

Funding:

The WTF approved a grant of $67,346 for this project. This contribution comes from funds allocated by the Ontario Ministry of the Environment.

Matching Funds:

The Ontario Ministry of the Environment provided the matching funds for this project.

11. "Effects of Acidic Precipitation on Waterfowl"

Co-ordinator:

Dr. Bill Freedman
Dept. of Biology
Dalhousie University

Description:

The fertilization of acidic lakes renders them eutrophic, and encourages a vigorous development of macrophytic and algal vegetation, benthic and planktonic invertebrates, waterfowl, and amphibious mammals. However, fertilization does not neutralize much of the acidity in such lakes, and there remain elevated concentrations of potentially toxic metals, particularly aluminum and mercury. Very little is known about the ecotoxicological hazards of metals in the invertebrate and plant foods of waterfowl that breed and/or feed on eutrophic acidic lakes, or for that matter on oligotrophic acidic lakes. However, it is reasonable to expect that metals ingested through the food web will accumulate in the body tissues of waterfowl feeding in acidic lakes.

Through this study, Dr. Freedman is measuring the seasonal concentrations of potentially toxic metals in the plant and invertebrate foods of ducks in one eutrophic and several oligotrophic lakes in Nova Scotia. Brood surveys are providing information on the importance of these lakes to waterfowl production. Collections and chemical analyses of feathers and body tissues of adult and young ducks are enabling the assessment of metal accumulation in the birds.

Funding:

The WTF approved a grant of $44,375 for this project.

Matching Funds:

The Natural Sciences and Engineering Research Council and Environment Canada provided the matching funds.

12. "Effects of Hexazinone Herbicides on Small Mammals"

Co-ordinator:

Mr. David Penner
Penner & Associates Ltd.

Description:

The researcher is conducting an intensive study on small mammals on comparable non-treated and herbicide-treated study areas over a four-year pre-treatment period on a vegetation-management research area. The researchers will monitor small mammal population characteristics including abundance, survival, reproductive success, behaviour, and species composition to determine if any changes are treatment related. Samples of representative small mammal species have been collected for tissues analysis of hexazinone residues to establish potential uptake, persistence, and possible consequences of the use of hexazinone herbicide on the food chain.

The study's final objective is to relate information from small mammal population characteristics, forage and animal tissue residue analysis, and habitat change data for an assessment of the presence of toxic chemicals in the food chain and an assessment of the potential for biological changes in wildlife which may be caused by the use of hexazinone herbicide.

Funding:

The WTF approved a grant of $30,838 for this project. The WTF provided previous support for the project in the amount of $55,000.

Matching Funds:

The Canada/Alberta Forest Resource Development Agreement, Canadian Forestry Service, Recreation Park and Wildlife Foundation, Environment Canada and Supply and Services Canada provided matching funds for the project.

13. "Experimental Acidification of a Wetland Ecosystem"

Co-ordinator:

Dr. Suzanne A. Bayley
Natural Resources Institute
University of Manitoba

Description:

The research is seeking to determine the effects of simulated acidic deposition on a 3.5 hectare oligotrophic wetland that has been experimentally acidified for five years. Effects on ecosystem components --- water chemistry, vegetation, amphibian, and insect fauna --- are being assessed in an acidified portion of the mire and in an unacidified control portion that contains only lake water. The WTF is sponsoring that part of the project dealing with internal wetland impacts, while the Department of Fisheries and Oceans is funding those portions emphasizing downstream effects and effects on metals.

The water chemistry of the wetland pools has just started to change after five years of acidification and these changes are being documented. Initially high plant production values have gradually decreased in the last three years. Control and experimental productivity was equal in 1988. The research is seeking to determine whether production rates will continue to decline. Peat accumulation rates are also being documented. The effect of acid deposition on the ability of Sphagnum to retain and neutralize acid ions is being assessed, including changes in the base cation exchange capacity of the wetland. Experiments to assess the ability of amphibians to tolerate acid deposition will be made in experimental and control areas of the wetland.

Funding

The WTF is providing a grant of $70,000 for the project.

Matching Funds

The WTF contribution has been matched by funds from the Department of Fisheries and Oceans.

14. "Impact of B.t. on Chicks of Spruce Grouse, Non-target Insects, and Small Birds and Mammals"

Co-ordinator:

Dr. J.F. Bendell
Faculty of Forestry
University of Toronto

Description:

B.t. is a preferred pesticide in forestry to control larvae of pest Lepidoptera because of its narrow spectrum of activity and the lack of demonstrated impacts on non-target vertebrates, insects, and even some species of non-target Lepidoptera. However, work by Dr. Bendell et al. suggests that B.t. kills non-target Lepidoptera of the low shrub layer of plantations of Jack Pine and indirectly kills chicks of Spruce Grouse by reducing the abundance of caterpillars they require for food.

Part of the problem of measuring the impact of insecticides is that methods may be narrow and imprecise. One approach is to use insectivores sensitive to changes in the abundance of larval Lepidoptera and easily monitored as indicators.

As this is the case with chicks of Spruce Grouse, the research is undertaking studies to more rigorously test the effect of B.t. on Spruce Grouse, insects of lower vegetation, and other birds, small mammals, and Amphibia that are in the forest used for work on grouse.

Funding

The WTF approved a grant of $14,450 for this project. This contribution comes from funds allocated by the Ontario Ministry of the Environment.

Matching Funds:

Matching funds for the project have been received from the Ontario Pesticides Advisory Council.

15. "The Effects of Carbofuran on the Growth, Development and Thermoregulatory Ability of Mallard Ducklings"

Co-ordinator:

Dr. Keith Solomon
Canadian Centre for Toxicology

Description:

The project is addressing the anti-cholinesterase pesticide, carbofuran, and its effects on mallard ducklings. In conjunction with research already carried out in the summer of 1988, the study is assessing the effects of sublethal carbofuran exposure upon the survival, growth, development, and thermoregulatory ability of mallard ducklings. Doses reflect those expected to be found in the wild.

Through the research, Dr. Solomon is determining the accumulation of carbofuran in potential aquatic duckling food sources, including invertebrates and floating macrophytes. He is also examining the interactive effects of sublethal carbofuran dosages with exposure to temperatures below the thermoneutral zone which might be encountered by wild ducklings in southern Manitoba. In addition, the duration of the depression of AChE activity in the plasma and brains of ducklings after a single carbofuran dosage is being determined. This will help to ascertain the period of greatest vulnerability to other environmental stressors.

Funding:

The WTF approved a grant of $5,500 for the research.

Matching Funds:

Matching funds have been secured from the Delta Waterfowl and Wetland Research Station.

16. "Effects of Environmental Exposure to Carbofuran and Mallard Ducks"

Co-ordinator:

Dr. Barrie Webster
Dept. of Soil Science
University of Manitoba

Description:

Carbofuran is sold for the control of various insect pests, particularly grasshoppers, in the Canadian prairie provinces. Treated fields and roadsides are often close to feeding and breeding areas of mallard ducks which evidently can ingest carbofuran via various routes, both environmental and dietary. In view of the great acute toxicity of this insecticide to birds, it is feared that the population of prairie mallard ducks may suffer significant harm as a result of this unintentional exposure. Further, sublethal behavioral aspects which are nevertheless relevant to duck population survival may also be affected; such effects may have been missed or ignored in earlier studies which focused on directly toxic (lethal) effects of carbofuran.

Through this project, mallard ducklings which are two to three days old are being exposed to grassland vegetation treated with carbofuran. Mortality, biological indicators of sublethality, and behavioural effects on the duckling will be followed in conjunction with detailed residue analysis for carbofuran and its major degradation products.

Funding:

The WTF has approved a grant of $61,000 for this project.

Matching Funds:

Matching funds have been received from the University of Manitoba.

17. "Toxicology and Pathology of St. Lawrence Marine Mammals"

Co-ordinator:

Dr. Pierre Beland
St. Lawrence National Institute
of Ecotoxicology

Description:

From 60 to 80 cetaceans and pinnipeds are reported dead along the St. Lawrence Estuary and Gulf annually. With support from the WTF, as well as the Department of Fisheries and Oceans, Alcan Aluminum Ltd., Greenpeace and the Quebec Wildlife Foundation, Dr. Pierre Beland and his team are collecting tissues from many of these carcasses to document health problems and various toxic compounds (organochlorines, PAHs and metals.) Beluga whales account for 20% to 30% of the marine mammal specimens found.

Results of this epidemological study have established the concurrence of particularly high levels of toxics in belugas along with a high incidence of various diseases, many of which are known to be induced by these compounds in experimental studies of other vertebrates. The comparison with other marine mammal species puts the beluga situation in proper perspective. Toxic compound levels appear to be related to diet and time of residence of each species in the system. A large portion of toxics in belugas originate in the Great Lakes.

Funding:

The Wildlife Toxicology Fund is providing a grant of $75,000 for the project.

Matching Funds:

Matching funds have been received from the Department of Fisheries and Oceans, Alcan Aluminum Ltd., Greenpeace and the Quebec Wildlife Foundation.

18. "The Interaction of Dioxins, Predation and Colony Size in Affecting Breeding Success of Great Blue Herons"

Co-ordinator:

Dr. Kim Cheng
Dept. of Animal Science
University of British Columbia

Description:

In the 1989 breeding seasons, experiment and observation were carried out to study the effects of poly-chlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzo-furans (PCDFs) contamination, colony size, predation, and the interaction of these three factors on the reproductive success of the Great Blue Heron. Productivity of 12 Great Blue Heron colonies (varying in number of breeding pairs) nesting along the Strait of Georgia were monitored and PCDD and PCDF levels of eggs from these colonies were estimated. Evidence of predation by bald eagles and crows was examined. Four of the 12 colonies will be monitored intensively and frequency of predation, reaction of herons to predators, and the relationship between incubation behaviour and egg predation are being measured.

The project is being carried out as part of a co-ordinated effort to study the effects of environmental PCDDD and PCDF on wildlife species. The data collected will complement physiological data collected by other researchers at the Canadian Wildlife Service and the University of British Columbia.

Funding:

The WTF approved a grant of $16,300 for the project.

Matching Funds:

The grant has been matched by funds from Fletcher Challenge, the Canadian Wildlife Service, the Cowichan Valley Naturalists Society and the Science Council of British Columbia.

19. "Availability and Effect on Waterfowl of Spent Lead Shot in the Maritime Provinces"

Co-ordinator:

Dr. Francis Schwab
Dept. of Biology
Acadia University

Description:

Research in the United States has demonstrated that spent lead shot from waterfowl hunters' guns causes lead poisoning in waterfowl. Those studies are responsible for a United States Fish and Wildlife Service ban on the use of lead shot to hunt waterfowl by 1991. There are virtually no data available in Canada with respect to the availability of lead shot and the effect that shot has on waterfowl.

In 1988, the Canadian Wildlife Service (Atlantic Region) initiated a project to determine the lead shot situation in the Maritime provinces. Following on that work, this project seeks to determine: 1) the volume of spent lead shot available to waterfowl in heavily hunted Maritime marshes; 2) the incidence of lead shot ingestion by Black Ducks and Ring-necked Ducks on selected wetlands; and 3) whether there is a lead poisoning problem in Maritime waterfowl populations.

Funding:

The WTF approved a grant of $33,600 for the project.

Matching Funds:

The grant has been matched by funds from the provincial governments of New Brunswick, P.E.I., and Nova Scotia, the Atlantic Veterinary College and the Canadian Wildlife Service.

20. "Effects of Toxaphene, Chlordane and Chlorinated Dibenzofurans on Hatching Success and Fry Survival of Lake Trout and White Suckers"

Co-ordinator:

Dr. Fred Ward
Dept. of Zoology
University of Manitoba

Description:

Recently there has been increasing concern over the amounts of contaminants such as toxaphene, chlordane and poly-chlorinated dibenzofurans in aquatic ecosystems and their effects on aquatic organisms. Although much is known about the acute toxicity of these contaminants, very little is known of the potential effects of the biomagnification of them on the population of organisms, in this case fish.

The study is examining the effects of high body burdens of toxaphene, chlordane and a pentachloro-dibenzofuran on reproductive success of white suckers and lake trout populations in Lake 260 at the Experimental Lakes area in northwestern Ontario. Adult fish are being exposed to the contaminant by an interperitoneal injection of one of the three toxicants on corn oil products. Residue analysis of parental fish and eggs will provide information on the amount of toxicant passed from parent to offspring. This information will be valuable in determining the current status of population and assessing the effect of contaminants on their reproductive potential.

Funding:

The WTF approved a grant of $40,000 for the project.

Matching Funds:

The grant has been matched by funds from the Natural Sciences and Engineering Research Council.

21. "Effects of Pyrethroid Pesticides on Early Development of Anuran Amphibians"

Co-ordinator:

Dr. Michael Berrill

Description:

Pyrethroid pesticides are neurotoxins which eliminate arthropods with little apparent harm to birds or mammals. Fish are far more sensitive than mammals to pyrethroids, and the little data available indicate that frogs may be about as sensitive as fish. Frog and toad communities may be particularly susceptible to pyrethroid exposure as eggs and tadpoles. Further, rapidly developing stages such as gastrulae and late pre-metamorphosis tadpoles may be more sensitive than more slowly growing stages. In addition, fast growing species may be more sensitive than slow growing species, and since pyrethroids are more effective at colder temperatures, early spring breeders may be more affected than late spring and summer breeders.

Through the project, these predictions will be tested. Dr. Berrill is measuring hatching success and success at metamorphosis following exposure of eggs to the pyrethroid and is examining the extent of abnormal neuro-muscular development in both embryos and tadpoles.

Funding:

WTF has approved a grant of $40,000 for the project.

Matching Funds:

The grant has been matched by funds from the Natural Sciences and Engineering Research Council and Trent University.

22. "Toxicity of Trace Metals to Benthic Invertebrate Communities: A Field Experimental Study"

Co-ordinator:

Dr. Landis Hare
INRS-Eau
University of Quebec

Description:

Trace metals such as cadmium and lead are major contaminants in many Canadian lakes and are presumed to have toxic effects on aquatic organisms, especially those living in sediments where concentrations of these pollutants are highest. Laboratory experiments have shown trace metals to have toxic effects on benthic organisms. However, the effects of chronic exposure to environmentally realistic levels of trace elements under natural conditions remains largely unknown.

Through the research, Dr. Hare will measure in situ the toxic effects of Cd, Cu, Pb, and Zn by comparing the invertebrate communities colonizing treated and untreated sediments with respect to their species abundance, richness, diversity and life histories.

Funding:

The WTF approved a grant of $40,000 for the project.

Matching Funds:

The grant has been matched by funds from the Natural Sciences and Engineering Research Council.

23. "Biochemical Indicators of Environmental Stress Caused by Toxic Metals"

Co-ordinator:

Dr. Peter Campbell
INRS-Eau
University of Quebec

Description:

Trace metals of anthropogenic origin tend to accumulate in aquatic sediments, where they pose a potential danger to benthic organisms and their predators. Dr. Campbell and his research team are seeking to elucidate the metal detoxification mechanisms that are operative in benthic invertebrates living in contaminated environments, and to evaluate the potential use of molecules involved in metal detoxification as biochemical indicators of the physiological state of these organisms.

Recommendations will be formulated with respect to the evaluation of metal stress on benthic organisms, and the prediction of changes in metal bioavailability that may result from man-induced perturbations such as acidification. The results will be of practical importance to those in public and private sectors who are concerned with the rational management of in situ contaminants and with the geochemical/biological consequences of the long range transport of airborne pollutants.

Funding:

The WTF has approved a grant of $45,000 for the project.

Matching Funds:

Matching funds have been received from the Natural Sciences Engineering and Research Council, INRS and FCAR.

24. "The Effects of Pulp Mill Effluent on Marine Bottom Fish and Bivalves"

Co-ordinator:

Dr. R. Reid
Dept. of Biology
University of Victoria

Description:

Recently, a ban has been placed on shellfish harvesting in areas within the Strait of Georgia, B.C. resulting toxic environmental contamination from pulp mill effluent. Due to the variable nature of pulp effluent from one mill to the next, and the extreme complexity of estuarine and coastal ecosystems, few generalizations can be made concerning the environmental impact of these effluents on marine organisms.

With support from the WTF, Dr. Reid is conducting a survey of two pulp mills along the British Columbia coastline, monitoring benthic deposit-feeding bivalves and flatfish for histopathological and biochemical changes resulting from pulp mill effluent. Influences by differences in species, sex, and seasonal changes will also be monitored. Cellular and biochemical changes resulting from exposure to pollutants with respect to time will be examined through translocation experiments. Food-chain interaction will also be considered by feeding untreated flatfish with bivalves previously exposed to contaminate sediments.

Funding:

The WTF has approved a grant of $40,000 for the project.

Matching Funds:

The grant has been matched by funds from the Natural Sciences and Engineering Research Council.

25. "Acid Stress Effects on the Physiology of Freshwater Clams"

Co-ordinator:

Dr. Brian McMahon
Dept. of Biosciences
University of Calgary

Description:

Bivalves are important and often dominant members of the freshwater benthic fauna. Because of their behaviour and unique physiology, they are a useful model for examining direct effects of acid deposition, specifically NOx pollution, on sensitive regulatory mechanisms.

Dr. McMahon is examining the effects of acid stress on the acid-base and ion regulatory mechanisms of this test animal. The intent is to characterize the direct effects of the acidic medium on these sensitive physiological parameters and to examine the possible ameliorating effects of increased calcium concentration.

Funding:

The WTF approved a grant of $35,726 for the project.

Matching Funds:

Matching funds have been secured from the Natural Sciences and Engineering Research Council.

26. "The Distribution and Prediction of Mercury in Freshwater Fish"

Co-ordinator:

Dr. Jacob Kalff
Dept. of Biology
McGill University

Description:

Elevated mercury concentrations in fish are common in North America and Europe and have resulted in restrictions on fish consumption by anglers and problems for native Canadians dependent on fish for part of their diet and culture. One major conclusion to be drawn from studies to date is the remarkable Hg variability encountered within and among fish species and environments in the northern hemisphere.

Dr. Kalff and his research team are seeking to establish a predictive model of mercury levels among and within fish species based on fish ecology and environmental characteristics. A large literature data set is being collected and analyzed for game fish species and their limnological environment in central and eastern Canada. Experimental work on three species is proposed to explain mechanisms underlying the literature derived patterns.

Funding:

The WTF has approved a grant of $31,250 for the project.

Matching Funds:

Matching funds have been secured from the FCAR and from the Natural Sciences and Engineering Research Council.

27. "The Effects of Dioxin on the Developing Avian Nervous System"

Co-ordinator:

Dr. John Steeves
Dept. of Zoology
University of British Columbia

Description:

Polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs)and polychlorinated biphenyls (PCBs) are chemically related, stable, highly toxic, virtually ubiquitous environmental contaminants which have been measured in relatively high levels in the eggs of Great Blue Herons in several colonies in B.C. and in Washington state. The most contaminated B.C. heron colony that has been measured is near the Crofton pulp and paper mill. It failed to produce any fledglings in 1987 and 1988.

The project will determine the effects of dioxin on the developing avian nervous system. Although the indicator species is the Great Blue Heron, the researchers are initially using chicken embryos as the model species to fully characterize dioxin's effects. They will also determine if Great Blue Heron embryos contaminated in the wild in ovo with a mixture of dioxins and furans have a nervous system morphology comparable to that of dioxin-treated chicken embryos.

Funding:

The WTF has approved a grant of $58,050 for the project.

Matching Funds:

Matching funds have been received from the Canadian Wildlife Service and the BC Health Care Research Foundation.

Appendix E

MEMBERS OF THE RESEARCH ADVISORY BOARD

OF THE WILDLIFE TOXICOLOGY FUND

Advisory Board Chairman

Dr. Donald A. Chant
Chairman and President
Ontario Waste Management Corp.
Toronto, Ontario

Dr. Gail Diane Bellward
Associate Dean of
Graduate Studies
Faculty of Pharmaceutical
Sciences
U.B.C.
Vancouver, B.C.

Dr. Don Ecobichon
Dept. of Pharmacology
and Therapeutics
McGill University
Montreal, Quebec

Dr. Claude Thellen
Scientific Advisor
Ministry of the Environment
Government of Quebec
Sainte-Foy, Quebec

Dr. David Peakall
Senior Research Scientist
Canadian Wildlife Service
Environment Canada
Hull, Quebec

Dr. Bruno Schiefer
Director
Toxicology Research Centre
University of Saskatchewan
Saskatoon, Saskatchewan

Dr. Peter Wells
Senior Advisor
Marine Environmental
Quality
Environmental Protection
Service
Dartmouth, Nova Scotia

* additional member to
be appointed shortly

Appendix F

PUBLICITY MATERIALS

This information was released to the wire services on the date indicated. Despite the delay, some releases and speeches are mailed to out-of-town media because the content is not time-dependent or because it will be useful for background files.

FOR IMMEDIATE RELEASE PR-HQ-088-48

THREE-YEAR PROGRAM TO FUND WILDLIFE TOXICOLOGY RESEARCH ANNOUNCED

BURLINGTON, ONT. -- 16 August, 1988 -- Renewal of a three-year, $1.6 million wildlife toxicology research fund was announced today by federal Environment Minister Tom McMillan and Monte Hummel, President of World Wildlife Fund Canada.

Environment Canada will provide $1 million over three years to the Wildlife Toxicology Fund (WTF), a grant program which supports high-calibre research on the impacts of toxic chemicals on wildlife.

The World Wildlife Fund (WWF) will continue to administer the program and will raise $600,000 from both the public and private sectors.

Research funds for 1988-1991 have already been pledged by the Quebec and Ontario governments. In addition, Noranda Inc. will continue its support for the administrative costs of the Wildlife Toxicology Fund with a $30,000 contribution to the program in the first year.

"The Wildlife Toxicology Fund has proven to be a highly successful example of what can be achieved when the public and private sectors work co-operatively on an environmental issue of shared concern," said Mr. McMillan. "The research supported by the Fund provides valuable information to protect wildlife from irreversible harm by toxic chemicals."

.../2

In this second three-year program, Wildlife Toxicology Fund research will focus on toxic chemicals, pesticides and air pollution.

Research grants under the Fund will be awarded by an independent board of experts in the field, chaired by Dr. D.A. Chant of the Ontario Waste Management Corporation. The fund will provide at least 50% of each project's cost.

Since its inception in 1985, the Wildlife Toxicology Fund has supported 52 wildlife toxicology projects in eight provinces and the two territories. These projects totalled $5.6 million, which levered an additional $3.4 million in funding from other sources.

World Wildlife Fund is the Canadian branch of the World Wide Fund for Nature, the largest private conservation organization in the world. The WWF represents 23 national organizations with a membership of two million members and is led by International President Prince Philip. Since its founding in 1961, this international network has raised over $500 million for 5,000 projects in 130 countries.

- 30 -

Further information and a copy of the list of projects funded to date can be obtained from:

Pegi Dover
World Wildlife Fund
(416) 923-8173

David B. Peakall
Environment Canada
(819) 997-2780

(Aussi disponible en français)

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Canadian Environment Week
June 4-10, 1989

Semaine canadienne de l'environnement
du 4 au 10 juin 1989

Our Common Future: It's in our hands

L'environnement : c'est l'affaire de tous

MEDIA ADVISORY

The Hon. Lucien Bouchard, federal Minister of the Environment, will address a gathering of business and conservation leaders at a reception to be held at **5:00 P.M., Tuesday, June 6th in the St. Lawrence Lounge, Macdonald Block, 900 Bay Street, Toronto.**

The reception is being held to highlight the achievements of the Wildlife Toxicology Fund, a program which has drawn together industry, government and non-government organizations in a unique partnership to support high-calibre research on the effects of toxic chemicals on wildlife. To date, more than 60 projects have been supported with a total value of more than $6 million.

While the initial supporters of the program were Environment Canada, World Wildlife Fund and Noranda Inc., financial participation in the Wildlife Toxicology Fund has now expanded to include a major new grant from Inco Ltd., as well as support form Alcan Aluminum Ltd., Esso Petroleum Canada Ltd., Polysar Ltd., Ontario Hydro, the Government of Ontario, the Government of Quebec, Fisheries and Oceans Canada and Greenpeace. Representatives from each of these organizations have been invited to the reception, as well as a number of other corporate and conservation leaders. Mr. Bouchard is in Toronto as part of a tour across the country during Environment Week, June 4 - 10.

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For Further Information:
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Canada

WWF World Wildlife Fund
Fonds Mondial pour la Nature

EMBARGOED
FOR RELEASE
JUNE 6, 1989
5 P.M.

INCO AWARDS GRANT TO WORLD WILDLIFE FUND FOR WILDLIFE TOXICOLOGY RESEARCH

World Wildlife Fund today announced that it has received a grant of $150,000 from Inco Limited in support of research on the effects of toxic chemicals on wildlife.

The grant, which was announced in Toronto at an Environment Week reception of business and conservation leaders, is in support of the Wildlife Toxicology Fund (WTF), an innovative research grant program launched in 1985 by Environment Canada, World Wildlife Fund and Noranda Inc. Since its inception, more than 70 projects with a total value of $6 million have been initiated. The applied research includes work on the effects of acid rain on wildlife, dioxin on herring gulls, grasshopper spraying on Prairie wildlife, petroleum oil on seabirds, and cadmium in moose and deer. A number of specific regulations and cleanup programs have already been undertaken as a result of this work.

Research grants under the WTF are awarded by an independent board of wildlife toxicology experts, chaired by Dr. Donald A. Chant of the Ontario Waste Management Corporation. The WTF provides up to 50% of each project's costs.

Inco joins a growing list of new financial supporters of the Wildlife Toxicology Fund. In addition to Inco, these include Alcan Aluminum Ltd., Esso Resources Canada Ltd., Polysar Ltd., Ontario Hydro, the Government of Ontario, the Government of Quebec, Fisheries and Oceans Canada and Greenpeace.

"WWF has worked to attract new funders to the research program and we are pleased to welcome Inco on board," Monte Hummel, President of WWF Canada, said. "It now means that we have an even broader array of corporate supporters working with WWF and Environment Canada to tackle this growing environmental concern."

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In announcing the contribution from Inco, WWF also released the slate of projects initiated by the WTF during 1988\1989. The projects cover a number of wildlife toxicology concerns, including the impact of acid rain on wildlife. For example, Dr. Bill Freedman of Dalhousie University has received a grant of $22,400 to assess the effects of acidic precipitation on ducks in Nova Scotia; the Long Point Bird Observatory has received $67,350 in funding to document the influence of lake acidification on the common loon and Dr. Jon Barlow, of the University of Toronto, has received a grant of $24,400 to research the effect of lake acidification and cadmium on birds. As the results from these and other projects become available, they are forwarded to government and industry policy-makers for follow-up action. A full list of these projects is appended.

World Wildlife Fund is the Canadian branch of the World Wide Fund for Nature, the largest private conservation organization in the world. The WWF network represents 27 national organizations with a membership of two million members, and is led by its International president HRH Prince Philip. Since its founding in 1961, this international network has raised over $500 million for 5,000 projects in 130 countries.

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For further information:

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Wildlife Canada will receive $1 million

BURLINGTON, Ont. (CP) — The federal government will give $1 million to the World Wildlife Fund Canada to study the impact of toxic chemicals on wildlife, Environment Minister Tom McMillan says.

The World Wildlife Fund, the Canadian branch of the World Wide Fund for Nature, will administer the grant and raise another $600,000 from both the public and private sectors to help pay for the research.

Environmental groups applauded the announcement but were disappointed that McMillan made no mention of a Tory proposal to create a $20-million toxicology centre in Guelph, Ont.

Feds fund study of chemicals on wildlife

BURLINGTON, Ont. (CP) — The federal government will give $1 million to the World Wildlife Fund Canada to study the impact of toxic chemicals on wildlife, Environment Minister Tom McMillan says.

The World Wildlife Fund, the Canadian branch of the World Wide Fund for Nature, will administer the grant and raise another $600,000 from both the public and private sectors to help pay for the research.

"The research supported by the fund provides valuable information to protect wildlife from irreversible harm by toxic chemicals," McMillan said Thursday.

Some of the research will focus on toxic chemicals, pesticides and air pollution.

Environmental groups applauded the announcement but were hoping that McMillan was going to announce a Tory proposal to create a toxicology centre in Guelph, Ont.

That centre would have done toxicology research on all kinds of animals and humans and set standards for a whole series of chemicals," said Kai Millyard, a spokesman for the environmental lobby group Pollution Probe. "What the WWF is doing is good but it is not really preventative."

McMillan made no mention of the $20-million centre, which was dropped in 1984 after the Conservative government was elected.

However, McMillan said in an interview that the idea of a world-class research centre is still being actively pursued but won't be entirely paid for by the federal government.

"It won't be the federal government alone — there will be many partners," McMillan said.

He said among the groups which have expressed an interest in the centre are the Chemical Producers Association of Canada, the University of Toronto and the Ontario government.

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CP photo

Studying effects of pollution on wildlife

Federal Environment Minister Tom McMillan, flanked by Supply and Services Minister Otto Jelinek, left, and World Wildlife Fund President Monte Hummel, right, announced yesterday a three-year, $1.6 million renewal of a program to study the effects of toxic chemicals, pesticides and air pollution on wildlife at the Canada Centre for Inland Waters in Burlington.

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Test would detect early signs of dioxins

By GIL HARDY
Ottawa Bureau
Thomson News Service

OTTAWA — A Montreal researcher is close to establishing a biological early-warning system to detect dioxins and other poisons in wildlife, a test that someday may do the same for humans.

Dr. Philip Spear began studying the relationship between toxic poisoning and Vitamin A levels in birds eight years ago while working on his PhD at the University of Ottawa. His work, which could lead to a cheaper, faster method of testing for environmental pollution, began almost by accident.

Spear was working in the National Research Council's environmental secretariat when he first noticed similiarities in the symptoms caused by dioxin contamination and Vitamin A deficiency.

"Actually, it wasn't part of my job at all," Spear, 39, said in a telephone interview from the University of Quebec at Montreal, where he now teaches. "I got fascinated with the question because I thought we might be able to do quite a bit in explaining dioxin toxicity if we understand how it affects Vitamin A."

Spear noticed in various reports he was reading at the NRC that both dioxin exposure and Vitamin A deficiency produced a skin rash and other similar symptoms. Spear set out to prove scientifically the relation between dioxin and Vitamin A deficiency.

He analyzed eggs from a "heavily contaminated" colony of cormorants in Michigan with those of a low exposure group from Manitoba's Lake Winnipegosis.

"The preliminary results show very different amounts of Vitamin A between the two colonies. It indicates that perhaps dioxins and other related compounds are having an impact on metabolism and Vitamin A," Spear said.

The possibility that dioxin affects Vitamin A levels has important consequences for human and animal life. Vitamin A, or retinoid, is vital to cell development and specialization.

If retinoid is proven susceptible to dioxins and other environmental pollutants, it would explain why animals experience lower birthrates and more deformities when exposed to contaminants. It would mean pollution not only kills wildlife but also threatens the very survival of a species, says Dr. Tom Moon, chairman of the University of Ottawa's biology department.

Spear's work may show that cleaning up a polluted environment is too late because dioxins have already affected reproduction, Moon said. "You are not going to get the species back."

Therefore, it's important to detect pollution before entire wildlife colonies are poisoned.

Tests do exist which determine whether wildlife has been contaminated, but they are expensive and time-consuming. That's because there are so many types of dioxins and other toxics that a thorough test takes time, money and specialized equipment.

"What we were looking for was a technology which was less complicated but was a broad indicator of intoxication by these kinds of compounds," said Moon, who supervised Spear's post-doctoral work.

The earlier findings have have proved useful to other researchers.

"There are other labs that are starting to measure Vitamin A levels in this regard and I think mainly because of the initial work that Phil did," Moon said.

The research has been funded by a few small federal grants over the years. The latest phase is supported by a $63,000 grant from the Calgary-based Max Bell Foundation and a similar amount from the World Wildlife Fund of Canada.

The new research involves an analysis of eggs and livers from various bird species living near the Great Lakes, mostly from Lake Ontario and Lake Erie. The work is being done in co-operation with the Canadian Wildlife Service and the U.S. Fish and Wildlife Service.

Spear is measuring retinoid levels in the Great Lakes' samples to establish correlations with dioxin contamination.

He hopes to create a "biological early-warning system" that would register poisoning far enough ahead to prevent deformities, the death of embryos and population decline. It could protect wildlife from an increasingly polluted environment.

Environment Canada Renews Wildlife Toxicology Fund

The renewal of the *Wildlife Toxicology Fund* for a second three-year period was announced in August by federal Environment Minister Tom McMillan and Monte Hummel, President of World Wildlife Fund Canada.

Environment Canada will provide $1 million over three years to the *Wildlife Toxicology Fund* (WTF). The World Wildlife Fund will continue to administer the program and will raise $600,000 from both the public and private sectors. Research funds for 1988-1991 have already been pledged by Ontario's Ministry of the Environment, the Quebec Department of the Environment and by Alcan Aluminum Ltd. In addition, Noranda Inc. will continue its support for the administrative costs of the Wildlife Toxicology Fund with a $30,000 contribution to the program in the first year.

"The *Wildlife Toxicology Fund* has proven to be a highly successful example of what can be achieved when the public and private sectors work co-operatively on an environmental issue of shared concern," said McMillan. "The research supported by the fund provides valuable information to protect wildlife from irreversible harm by toxic chemicals."

Since its inception in 1985, the WTF has supported 52 wildlife toxicology projects in eight provinces and the territories. The total value of these projects is $5.6 million. Thus, funding from Environment Canada in the amount of $2.2 million has catalyzed an additional $3.4 million in funding from other sources. The WTF will only fund research proposals to a maximum of 50 percent of the cost of the project. All WTF decisions are made by an independent Research Advisory Board, comprised of experts in the field of wildlife toxicology and chaired by Dr. D.A. Chant of the Ontario Waste Management Corporation.

Research under the WTF has been of direct relevance to a number of critical wildlife toxicology issues confronting the country. These include the impact on wildlife of toxic industrial chemicals, acid rain, prairie pesticides and heavy metals.

Among the projects to be funded under the renewed agreement is an assessment of toxic chemical levels in Beluga Whales and other marine mammals in the St. Lawrence River. Chemical pollution has been suspected as a key factor in the decline of the endangered St. Lawrence River Beluga. Dr. Pierre Beland, of the St. Lawrence National Institute of Ecotoxicology, is heading the research project and WWF has secured additional funds for the project from Alcan Aluminum Limited and Fisheries and Oceans Canada.

"It's very important for Canadian wildlife that the *Wildlife Toxicology Fund* continue," Hummel said. "The St. Lawrence River Beluga is an endangered species, with only a few hundred of the original few thousand whales remaining. The research will provide us with the information needed to protect and enhance this population."

For a copy of the Third Annual Report of the Wildlife Toxicology Fund, contact Pegi Dover, World Wildlife Fund, Suite 201, 60 St Clair Avenue East, Toronto, M4 1N5.

Working for Wildlife Summer 1988

Inco Grants $150,000 to Wildlife Toxicology Fund

Inco Ltd. has provided a three-year grant of $150,000 for WWF's *Wildlife Toxicology Fund*, a research program designed to assess the impact of toxic chemicals on Canadian wildlife.

Initiated in 1985 as a co-operative grant program involving WWF, Environment Canada and Noranda Inc., the *Wildlife Toxicology Fund* has to date funded more than 60 research projects with a total value exceeding $6.5 million. These are addressing key concerns, including the effects of Great Lakes contamination on wildlife; the impact of acid rain on wildlife; the effect of pesticides on the aquatic and terrestrial life of the prairies and the contamination of Arctic wildlife and marine ecosystems. Once the research is completed, the results are channelled to appropriate individuals in industry and government for follow-up action.

"Inco's support is greatly appreciated and is now being channelled to critical research initiatives," Monte Hummel, President of WWF, said. "This spring we have launched a number of new projects. For example, WWF researchers will be looking at the impact of acid rain on Common Loons in Ontario and on ducks in Nova Scotia. In addition, research is underway to assess the impact of toxic chemicals on Beluga Whales and determine the effect of specific insecticides on a variety of wildlife."

In 1988, the *Wildlife Toxicology Fund* was re-established for a second three-year phase with the intent of broadening participation beyond the initial funders. Thus, Inco joins a growing list of new supporters to the *Wildlife Toxicology Fund*. Alcan Aluminum Ltd., Ontario Hydro, the Department of Fisheries and Oceans, the Ontario Ministry of Environment, the Quebec Ministry of the Environment

See Toxicology – cont'd on p. 4

Working For Wildlife Sept. 1989

Toxicology – cont'd from p. 3

and Greenpeace have all provided core research funding for the program. Noranda Inc. continues to cover all the administrative costs of the *Wildlife Toxicology Fund*.

All funding decisions are made by an independent Research Advisory Board, comprised of some of Canada's top experts in the field of wildlife toxicology. The board is chaired by Dr. Donald A. Chant, Chairman and President of the Ontario Waste Management Corporation.